

REMARKS

The Office Action dated September 18, 2006 has been received and carefully noted. The above amendments to the claims and the following remarks are submitted as a full and complete response thereto. Claim 27 has been amended and new claim 29 includes recitations from independent claim 1, claim 3, and allowed claim 4. No new matter is being presented, and approval and entry are respectfully requested. Claim 4 is cancelled without prejudice or disclaimer. Because new claim 29 recites allowable subject matter, as also confirmed in the Office Action, it is respectfully requested that claim 29 be allowed.

RESTRICTION REQUIREMENT:

In the Office Action Summary, claims 18 and 22 were subject to a restriction and/or election requirement. Because the pending Office Action did not address the reasons for considering claims 18 and 22 along with the remaining claims presented in the Applicant's Response of June 26, 2006, the arguments previously presented traversing the restriction requirement are once again presented. It is respectfully requested that these arguments be considered and that the patentability of claims 18 and 22 be considered.

It is respectfully submitted that the Office Action has not presented any reasoning or explanation supporting why claims 18 and 22 should be subject to such restriction and/or election requirement. It is respectfully indicated that claims 18 and 22 are

dependent claims of independent claim 1 and further define the recitations being recited in independent claim 1.

Applicant respectfully submits that it is no additional burden to examine the subject matter of claims 18 and 22. Examination of all of claims 1-28, therefore, is respectfully requested.

Claims 1-28 are directed to a mixer arrangement and a method for mixing signals in a mixer arrangement. Claim 18 is dependent upon claim 1, and further defines that the first mixer recited in independent claim 1 is configured to up convert the frequency of the at least signal received at the at least one signal input. Claim 22 is dependent upon claim 1, and further defines that the at least one signal recited in independent claim 1 is unconverted to a radio frequency. If the subject matter of claim 1 is found allowable, therefore, the subject matter of claims 18 and 22 should also necessarily be allowable. Therefore, no additional search or additional burden is necessary. Accordingly, it is respectfully requested that pending claims 1-28 be considered.

REJECTION UNDER 35 U.S.C. § 102:

In the Office Action, at page 2, claims 1-3, 15-17, 19-21, and 24-28 were rejected under 35 U.S.C. § 102 as being anticipated by GB 2,236,225 to Seymour (“Seymour”). The Office Action took the position that Seymour describes all the recitations of independent claims 1, 27, 28, and 29 and related dependent claims. This rejection is traversed and reconsideration is requested.

Independent claim 1, upon which claims 2-26 are dependent, recites a mixer arrangement including a first mixer having at least one signal input configured to receive a first signal including a frequency of which is to be changed, at least one frequency input for receiving an input frequency and at least one output, the first mixer being configured to mix the first signal with the input frequency to provide an output which is output by the at least one output. A second mixer having at least one frequency input is configured to receive the input frequency and having at least one output. The at least one output of the first mixer and at least one output of the second mixer being combined to cancel unwanted components in the outputs of the mixers, and the unwanted components comprise the input frequency.

Independent claim 27 recites a method including receiving a first signal at a first mixer, wherein the first signal includes a frequency to be changed, receiving an input frequency input at the first mixer, mixing the first signal with the frequency input to provide a first output from the first mixer, receiving the input frequency at a second mixer, and outputting a second output from the second mixer. The method also includes combining the first output of the first mixer and the second output of the second mixer to cancel unwanted components in the outputs of the mixers. The unwanted components comprise the input frequency.

Independent claim 28 recites a mixer arrangement comprising first receiving means for receiving a first signal at a first mixer, wherein the first signal includes a frequency to be changed, second receiving means for receiving an input frequency input

at the first mixer, and mixing means for mixing the first signal with the frequency input to provide a first output from the first mixer. The mixer arrangement also comprises third receiving means for receiving the input frequency at a second mixer, outputting means for outputting a second output from the second mixer, and combining means for combining the first output of the first mixer and the second output of the second mixer to cancel unwanted components in the outputs of the mixers. The unwanted components comprise the input frequency.

Independent claim 29 recites a mixer arrangement including a first mixer having a single signal input configured to receive a first signal including a frequency of which is to be changed, a single frequency input for receiving an input frequency and a single output, the first mixer being configured to mix the first signal with the input frequency to provide an output which is output by the single output. The mixer arrangement also includes a second mixer having a single frequency input configured to receive the input frequency and having a single output. The mixer arrangement also includes combiner configured to select an output from one of the first and second mixers, to invert the selected output, and to add the inverted selected output to the non-selected output of the first and second mixers in order to cancel unwanted components in the outputs of the mixers. The unwanted components comprise the input frequency.

Seymour generally describes an input signal including two frequency components f_a and f_b centered about zero frequency. In FIG. 1 of Seymour, the input signal is the signal that is output from element 19 and input to element 23. The goal of the apparatus

of Seymour is to upconvert the input signal such that the two frequency components maintain their relative composition but are now centered about frequency f_2 . A well known method of doing this is to combine the input signal with a signal of frequency f_2 generated by a local oscillator (25). The two signals to be combined provide the inputs to a mixer (23). Because the two signals are waveforms, two terms of distinct frequencies result from their combination: $[f_2 + (f_a - f_b)]$ and $[f_2 - (f_a - f_b)]$. The first term is the desired product: a signal comprising two frequency components f_a and f_b centered about the frequency f_2 . The second term is known as an image frequency and is the “unwanted mixing product” referred to in the section of page 4, lines 11-20 of Seymour. It is also referred to in Seymour as the “unwanted spurious product” and depicted as A1 in FIGS. 2 and 3.

Seymour's circuit is a circuit which eliminates the image frequency. The circuit of Seymour splits the initial input into two input signal channels. Each input signal follows a path through identical apparatus with the exception that one of the signals is exposed to phase shifters at two points in the circuit (4), (27). The result of the circuit of Seymour is that one signal includes the unwanted spurious product, mentioned above, in addition to the desired product; and the other signal comprises the unwanted spurious product phase-shifted by 180° , in addition to the desired product. When these two signals are recombined at the summer (29) the two unwanted spurious products cancel because they are in antiphase, yielding the desired product only.

In contrast, in the present application, the input signal to be upconverted has a frequency A, which is to be mixed with a signal of frequency B generated by a local oscillator. As described in paragraphs [0004] and [0005] of page 2 of the present application,

“mixers which are used for this purpose also allow the input signals to feed through the mixer. This means that the mixer will output the A+B frequency signals and also the signal at frequency A and the signal at frequency B. This can be a problem in that the frequency B is generally much greater than frequency A so that B is relatively close to the frequency A + B.....If the unwanted signal at frequency B is not filtered, this can lead to more harmful intermodulation products that can fall within the band of the wanted output. This produces loss of performance in the transmitter as the spectral purity is degraded.”

Because frequency A of the input signal is typically low relative to frequency B, unwanted component of the input signal with frequency A is easily filtered out from the output from the mixer.

Accordingly, in accordance with an embodiment, the present application provides a mixer arrangement that eliminates the unwanted input signals (signal with frequency) from featuring in the resultant output. In Seymour's description, the input signals will propagate through to the output. At no point in its description does Seymour teach or suggest a solution to this problem. In an embodiment of the present invention, illustrated in FIG. 6 and described in paragraphs [0034] to [0039] of the Specification, a first mixer (52) receives four inputs: the signal to be upconverted (at frequency A)(56), the inverse of the signal to be upconverted (58), the output (60) of a local oscillator and the inverted output (62) of the local oscillator. This first mixer (52) outputs two signals: one with

frequency components A, B and A+B; the other with inverse frequency components A, B and A+B. A second mixer (54) also receives four inputs: the output (72) of a local oscillator, the inverted output (74) of the local oscillator, and two further inputs connected to each other via a resistive element (80) which has a resistance equivalent to that of the first input (56) to the first mixer (52). This second mixer outputs two signals: one with frequency B; the other with inverse frequency B. By connecting the first output of the first mixer with the second output of the second mixer the resultant output will have frequency components A, B, A+B and inverse B. The B and inverse B components cancel, leaving A and A+B. In other words "at least one output of the first mixer and at least one output of said second mixer being combined to cancel unwanted components in the outputs of said mixers, and wherein said unwanted components comprise said input frequency," as recited in independent claims 1, 27, and 28. Frequency component A is easily removed by filtering, leaving the desired product frequency A+B.

Thus, Seymour addresses a different problem associated with a mixer from the recitations of independent claims 1, 27, and 28. Seymour discloses a circuit to eliminate the problem of image frequencies. These image frequencies are "unwanted mixing products" (page 4, line 19), i.e., the image frequencies are not the original input signals, but rather signals resulting from the mixing process itself. The present invention eliminates the input frequencies from the output. In paragraph [0045] of the Specification of the present application, it is mentioned that the unwanted frequency A-B

will be present in the output. It is described that “an image reject mixer can be used to remove the unwanted frequency.” Seymour, however, does not mention the problem addressed by the present invention. Thus, Seymour fails to teach or suggest all the recitations of independent claims 1, 27, and 28 and related dependent claims.

A clarifying amendment was made to the independent claims in response to the previous Office Action. The amendment was to specify that the unwanted components in the outputs which would cancel comprise the input frequency. This input frequency is clearly different to the unwanted image frequency, since the unwanted image frequency is not an input frequency.

Applicant further submits that the problem of canceling components of the input frequency present in the mixer output is not recognized at all in Seymour, nor does Seymour teach the solution as recited in claim 1. Thus, Seymour fails to teach or suggest all the recitations of independent claims 1, 27, and 28 and related dependent claims.

In view of the foregoing, it is respectfully requested that independent claims 1, 27, and 28 and related dependent claims be allowed.

REJECTION UNDER 35 U.S.C. § 103:

In the Office Action, at page 7, claims 5-6 and 12-13 were rejected under 35 U.S.C. § 103 as being unpatentable over Seymour in view of GB 2,239,143 to Rokos (“Rokos”). The Office Action took the position that Seymour discloses all of the elements

of independent claim 1, with the exception of the recitations of dependent claims 5-6 and 12-16. The Office Action then relies upon Rokos as allegedly curing this deficiency in Seymour. The rejection is traversed and reconsideration is requested.

As will be discussed below, Seymour and Rokos fail to disclose or suggest the elements of any of the presently pending claims.

Dependent claims 5-6 and 12-13 depend from independent claim 1. Because the combination of Seymour and Rokos must teach, individually or combined, all the recitations of the base claim and any intervening claims of dependent claims 5-6 and 12-13, the arguments presented above supporting the patentability of independent claim 1 over Seymour are incorporated herein.

Rokos generally describes a circuit arrangement providing a reduction in the output noise from each of a doubly balanced mixer stages. See page 3 of Rokos. Incoming r.f. signals are applied to two balanced amplifiers. Balanced outputs A, B, and C, D of the amplifiers are fed to two balanced mixers formed by respective sets of transistors T5-T8 and T9-T12, where they are mixed with balanced local oscillator signals in quadrature. The outputs of the mixer stages are balanced baseband signals. However, Rokos fails to cure the deficiencies of Seymour. Rokos does not teach or suggest that the circuit arrangement may include a first mixer and a second mixer, in which the first mixer has “at least one signal input configured to receive a first signal including a frequency of which is to be changed,” as recited in independent claim 1. Furthermore, Rokos is devoid of any description or suggestion providing, “wherein at

least one output of the first mixer and at least one output of said second mixer being combined to cancel unwanted components in the outputs of said mixers, and wherein said unwanted components comprise said input frequency,” as recited in independent claim 1. Rokos is silent as to teaching or suggesting combining the output of the first mixer and the output of the second mixer to cancel unwanted components in the outputs of the mixers, where the unwanted components comprise said input frequency.

Accordingly, a combination of Seymour and Rokos would fail to teach or suggest all the recitations of independent claim 1 and related dependent claims. It is respectfully requested that independent claim 1 and related dependent claims 5-6 and 12-13 be allowed.

In the Office Action, at page 8, claims 7 and 23 were rejected under 35 U.S.C. § 103 as being unpatentable over Seymour in view of U.S. Patent No. 6,510,314 to Kuo (“Kuo”). The Office Action took the position that Seymour discloses all of the elements of independent claim 1, with the exception of the recitations of dependent claims 7 and 23. The Office Action then relies upon Kuo as allegedly curing this deficiency in Seymour. The rejection is traversed and reconsideration is requested.

As will be discussed below, Seymour and Kuo fail to disclose or suggest the elements of any of the presently pending claims.

Dependent claims 7 and 23 depend from independent claim 1. Because the combination of Seymour and Kuo must teach, individually or combined, all the

recitations of the base claim and any intervening claims of dependent claims 7 and 23, the arguments presented above supporting the patentability of independent claim 1 over Seymour are incorporated herein.

Kuo generally describes a mixer circuit on integrated circuits that is used to convert between radio frequency (RF) signals and intermediate frequency (IF) signals in the wireless communications devices. See column 1, lines 7-12. Mixer 70 operates to mix or multiply the RF signals at RF input port 20 and the LO signals at LO input port 22 to produce the first and second intermediate signals at first and second intermediate ports 26, 28. See column 5, lines 40-62. As the transistors 16a-16d are turned on and off, the currents flowing through the collectors of transistors 16a-16d approximate the product of the RF signals and square waves having the frequency of the LO input signals. In the frequency domain, these resulting currents include a variety of frequency components, including components of the desired IF frequency. The frequency components that are produced other than the desired IF frequency component must be filtered out for proper operation of the mixer 70.

However, Kuo fails to cure the deficiencies of Seymour. Kuo is devoid of any description or suggestion providing, “wherein at least one output of the first mixer and at least one output of said second mixer being combined to cancel unwanted components in the outputs of said mixers, and wherein said unwanted components comprise said input frequency,” as recited in independent claim 1. Instead, Kuo describes that the frequency components that are produced other than the desired IF frequency component must be

filtered out for proper operation of the mixer 70. Nothing in Kuo describes that the unwanted components is the input frequency as recited in independent claim 1. Kuo is silent as to teaching or suggesting combining the output of the first mixer and the output of the second mixer to cancel unwanted components in the outputs of the mixers, where the unwanted components comprise said input frequency.

Accordingly, a combination of Seymour and Kuo would fail to teach or suggest all the recitations of independent claim 1 and related dependent claims. It is respectfully requested that independent claim 1 and related dependent claims 7 and 23 be allowed.

In the Office Action, at page 9, claims 8-10 were rejected under 35 U.S.C. § 103 as being unpatentable over Seymour in view of U.S. Publication No. 2005/0172718 to Kalinin (“Kalinin”). The Office Action took the position that Seymour discloses all of the elements of independent claim 1, with the exception of the recitations of dependent claims 8-10. The Office Action then relies upon Kalinin as allegedly curing this deficiency in Seymour. The rejection is traversed and reconsideration is requested.

As will be discussed below, Seymour and Kalinin fail to disclose or suggest the elements of any of the presently pending claims.

Dependent claims 8-10 depend from independent claim 1. Because the combination of Seymour and Kalinin must teach, individually or combined, all the recitations of the base claim and any intervening claims of dependent claims 8-10, the

arguments presented above supporting the patentability of independent claim 1 over Seymour are incorporated herein.

Kalinin generally describes an arrangement for tracking resonant frequency of electrically resonant structures through a single channel includes a variable frequency oscillator associated with each resonant structure which provides an excitation signal of a variable frequency encompassing a possible resonant frequency of the associated resonant structure. Coupling device(s) are provided which connect each variable frequency oscillator to said resonant structure(s). An I-mixer is provided for each oscillator which forms a synchronous detector, a first input of each I-mixer being connected to its associated oscillator and a second input being connected to the coupling device, each I-mixer mixing the excitation signal from the associated variable frequency oscillator with a response signal generated by the resonant structure(s) in response to each excitation signal. The output of each I-mixer is filtered to remove sum products of the excitation and response signals, thereby leaving an amplitude modulation component of the signal, which is processed in a control loop to track the resonant frequency of each resonant structure.

However, Kalinin fails to cure the deficiencies of Seymour. Kalinin does not teach or suggest that the circuit arrangement may include a first mixer and a second mixer, in which the first mixer has “at least one signal input configured to receive a first signal including a frequency of which is to be changed,” as recited in independent claim 1. Furthermore, Kalinin is devoid of any description or suggestion providing, “wherein at

least one output of the first mixer and at least one output of said second mixer being combined to cancel unwanted components in the outputs of said mixers, and wherein said unwanted components comprise said input frequency,” as recited in independent claim 1. Instead, Kalinin focuses on removing sum products of the excitation and response signals. Thus, Kalinin is silent as to teaching or suggesting combining the output of the first mixer and the output of the second mixer to cancel unwanted components in the outputs of the mixers, where the unwanted components comprise said input frequency.

Accordingly, a combination of Seymour and Kalinin would fail to teach or suggest all the recitations of independent claim 1 and related dependent claims. It is respectfully requested that independent claim 1 and related dependent claims 8-10 be allowed.

In the Office Action, at page 10, claim 11 was rejected under 35 U.S.C. § 103 as being unpatentable over Seymour in view of U.S. Patent No. 6,687,494 to Mourant (“Mourant”). The Office Action took the position that Seymour discloses all of the elements of independent claim 1, with the exception of the recitations of dependent claim 11. The Office Action then relies upon Mourant as allegedly curing this deficiency in Seymour. The rejection is traversed and reconsideration is requested.

As will be discussed below, Seymour and Mourant fail to disclose or suggest the elements of any of the presently pending claims.

Dependent claim 11 depends from independent claim 1. Because the combination of Seymour and Mourant must teach, individually or combined, all the recitations of the

base claim and any intervening claims of dependent claim 11, the arguments presented above supporting the patentability of independent claim 1 over Seymour are incorporated herein.

Mourant generally describes first and second doubly balanced mixers which convert a common radio frequency signal to an intermediate frequency signal. The first doubly balanced mixer produces a pair of differential currents which represent the sum and difference of the local oscillator signal and a radio frequency signal. A second doubly balanced mixer frequency converts the same radio frequency signal producing a pair of differential currents representing the sum and difference of the radio frequency signal, using a ninety degree phase shifted version of the local oscillator signal. The first and second pairs of differential signals are combined in a quadrature combining circuit to produce a differential intermediate frequency signal substantially free of signal images.

However, Mourant fails to cure the deficiencies of Seymour. Mourant does not teach or suggest that the circuit arrangement may include a first mixer and a second mixer, in which the first mixer has “at least one signal input configured to receive a first signal including a frequency of which is to be changed,” as recited in independent claim 1. Furthermore, Mourant is devoid of any description or suggestion providing, “wherein at least one output of the first mixer and at least one output of said second mixer being combined to cancel unwanted components in the outputs of said mixers, and wherein said unwanted components comprise said input frequency,” as recited in independent claim 1. Instead, Mourant focuses on differential currents representing the sum and difference of

the radio frequency signal and producing a differential intermediate frequency signal substantially free of signal images. Thus, Mourant is silent as to teaching or suggesting combining the output of the first mixer and the output of the second mixer to cancel unwanted components in the outputs of the mixers, where the unwanted components comprise said input frequency.

Accordingly, a combination of Seymour and Mourant would fail to teach or suggest all the recitations of independent claim 1 and related dependent claims. It is respectfully requested that independent claim 1 and related dependent claim 11 be allowed.

In the Office Action, at page 11, claim 14 was rejected under 35 U.S.C. § 103 as being unpatentable over Seymour in view of U.S. Patent No. 5,661,485 to Manuel (“Manuel”). The Office Action took the position that Seymour discloses all of the elements of independent claim 1, with the exception of the recitations of dependent claim 14. The Office Action then relies upon Manuel as allegedly curing this deficiency in Seymour. The rejection is traversed and reconsideration is requested.

As will be discussed below, Seymour and Manuel fail to disclose or suggest the elements of any of the presently pending claims.

Dependent claim 11 depends from independent claim 1. Because the combination of Seymour and Manuel must teach, individually or combined, all the recitations of the base claim and any intervening claims of dependent claim 14, the arguments presented

above supporting the patentability of independent claim 1 over Seymour are incorporated herein.

Manuel generally describes a homodyne method and an apparatus that produces an output signal with inherently lower spurious content than is possible with conventional approaches to homodyne reception. The apparatus of the present invention comprises means for providing first and second signals from an input signal and means for generating first and second oscillator signals. The first signal and first oscillator signal are mixed and the second signal and the second oscillator signal are mixed in a plurality of means for mixing signals. The plurality of means for mixing signals provides first and second mixed signals which are further mixed together with another of the plurality of means for mixing. The means for generating first and second oscillator signals can be a plurality of oscillators, each generating an oscillator signal which is subsequently mixed, or an offset oscillator and a power divider for dividing the offset oscillator signal into two oscillator signals.

However, Manuel fails to cure the deficiencies of Seymour. Manuel does not teach or suggest that the circuit arrangement may include a first mixer and a second mixer, in which the first mixer has “at least one signal input configured to receive a first signal including a frequency of which is to be changed,” as recited in independent claim 1. Furthermore, Manuel is devoid of any description or suggestion providing, “wherein at least one output of the first mixer and at least one output of said second mixer being combined to cancel unwanted components in the outputs of said mixers, and wherein said

unwanted components comprise said input frequency," as recited in independent claim 1. Instead, Manuel is silent as to teaching or suggesting combining the output of the first mixer and the output of the second mixer to cancel unwanted components in the outputs of the mixers, where the unwanted components comprise said input frequency.

Accordingly, a combination of Seymour and Manuel would fail to teach or suggest all the recitations of independent claim 1 and related dependent claims. It is respectfully requested that independent claim 1 and related dependent claim 14 be allowed.

CONCLUSION:

In view of the above, Applicant respectfully submits that the claimed invention recites subject matter which is neither disclosed nor suggested in the cited prior art. Applicant further submits that the subject matter is more than sufficient to render the claimed invention unobvious to a person of skill in the art. Applicant therefore respectfully requests that each of claims 1-3 and 5-28 be found allowable and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the Applicant respectfully petitions for an appropriate extension of time.

Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,



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Enclosures: Additional Claim Fee Transmittal
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